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The Role of Technology Adoption within the Department of Energy's Solar Energy Technologies Program

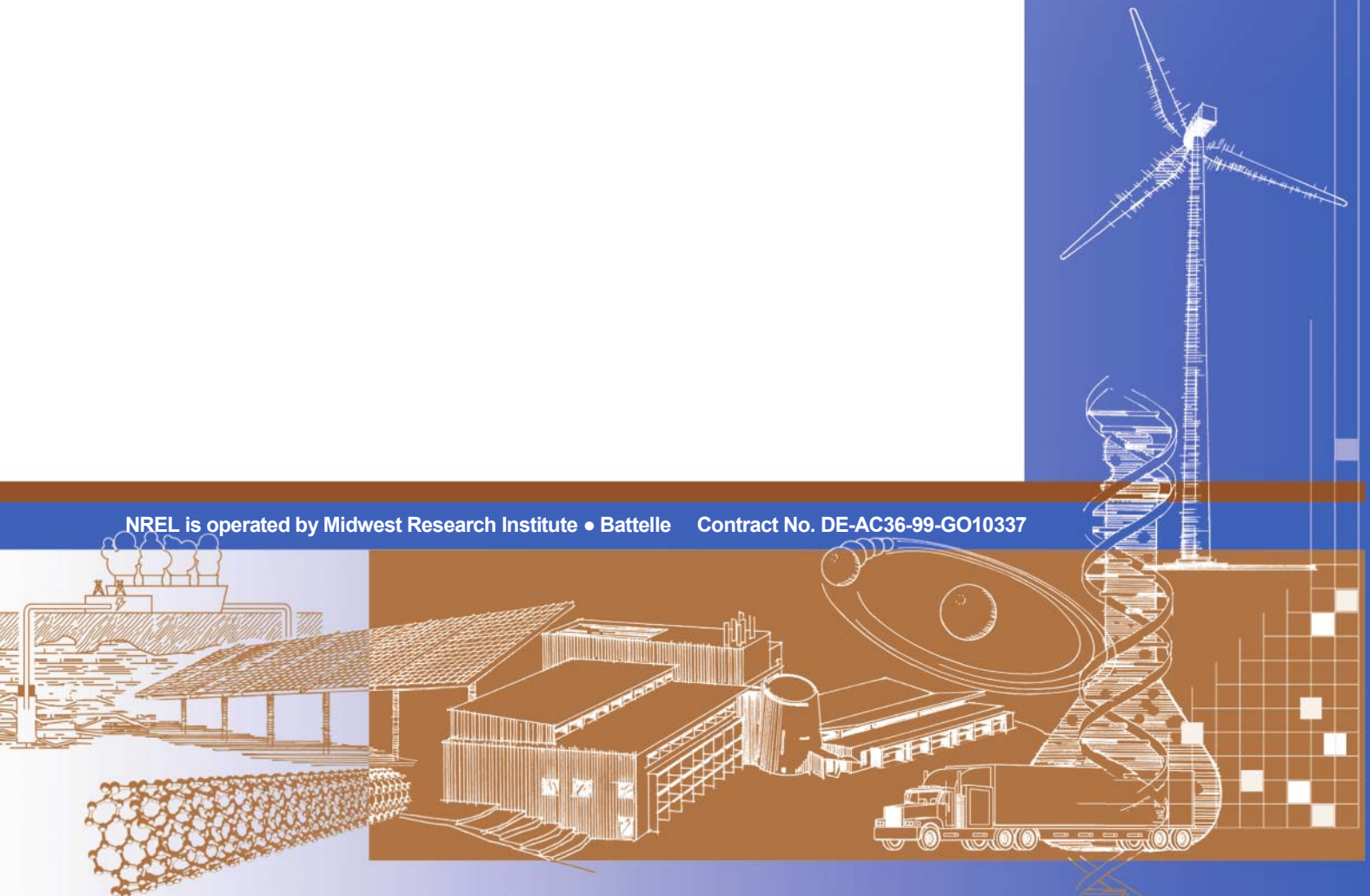
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The Role of Technology Adoption within the Department of Energy's Solar Energy Technologies Program

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ABSTRACT

Several technical activities are undertaken on behalf of DOE's Solar Energy Technologies Program in the interests of increasing the broader adoption of solar technologies in the marketplace. Included in these activities are technical support to the development of electrical codes and standards; installer and hardware certification programs; domestic and international technical support activities with leveraged partners; developing new systems configurations, such as building-integrated systems; and studies on environmental, safety, and health-related aspects of production. These technology adoption (TA) activities provide a valuable link between the systems-driven approach (SDA), and both fundamental and applied R&D within the program. Through TA support, the Solar Energy Technologies Program is able to identify market-based needs through data gathering and analysis and to communicate these needs to program researchers. In addition, TA activities maintain the role of the DOE and the laboratories as impartial brokers of information as the markets for these products continue to grow.

1. Importance of TA Activities

Getting a new technology adopted by either a specific user group or by the general public has been shown repeatedly to be extremely difficult. Even though a newer technology may have obvious benefits over older, more established technologies, acceptance is rarely "a done deal."

"Technical diffusion" is a general term that describes the process by which a new idea is adopted and has been applied to all fields of human endeavor. The term is often applied to both the planned and spontaneous spread of new ideas. In this paper, we restrict the use to those planned activities funded by the Solar Energy Technologies Program.

Many innovations that we routinely accept today, such as the automobile and alternating-current (ac) electricity, actually took many years before they gained widespread acceptance. Some examples are provided below.

Hirsh [1] describes several transformations in the electric utility industry where the electrical generating equipment in use at the time reached its technical or social limitations. Of particular interest is his description of the resistance by the utility industry to changing from small, locally sited, and inefficient direct-current (dc) generating power stations of the early 1900s to larger, centrally sited, and more efficient ac generating stations. Similarly, he describes the later resistance to distributed generation as the large plants approached their technical and economic limitations, while smaller-scale technologies, such as gas turbines, steadily improved in both performance and cost of operation.

One of the classic studies of successful technology diffusion involves the introduction of hybrid seed corn in Iowa by the U.S. Department of Agriculture (USDA). Hybrid seed corn had demonstrated greatly improved yields, and, therefore, profits. Yet, its introduction met with great resistance. The USDA finally won over the farmers by providing hybrid seed to the most influential farmer in the region, assisting him to ensure a good crop, and demonstrating that the new hybrid corn made economic sense [2]. Although this case seems unrelated to the Solar Program at first, anyone involved in solar deployment will soon identify with the experiences of the USDA staff.

The success of technology diffusion rests largely on communication, whether it is through public hearings, workshops, or lectures, or through technical assistance. Rogers [3] documents a wide range of technologies or ideas that, although commonplace today, may have never successfully reached the marketplace without directed TA efforts.

The references below are well worth reading. Solar advocates will quickly identify with the problems that other technologists have faced and will obtain valuable insights that may improve their own efforts.

2. TA Activities in Solar Energy Technologies Program

Technology adoption activities in the Solar Energy Technologies Program cover a broad spectrum. Many of these activities are discussed in the papers presented in the two Technology Adoption sessions of the Solar Program Review Meeting.

These activities seem to be unrelated at first glance. Yet, they do have many challenges in common. They all:

- Have the goal of accelerating the adoption of solar technologies
- Increase understanding and improve expectations of customers and users
- Provide valuable market-related information, and
- Provide opportunities to leverage R&D funding through collaboration.

The Solar Energy Technologies Program is unique in that it acts as a focal point for field experience and state-of-the-art developments. It is the largest repository of solar-related information in the world. This places the Program in an advantageous position to use this informational database to accelerate the adoption of solar technologies. We approach the dissemination of this information in several ways.

Technical assistance enables us to stimulate other governmental agencies to use solar technologies. For example, as the largest owner of buildings in the world, the federal government can set a decisive example for the rest of the U.S building owners. Assistance to the private sector provides the latest information—and often, the incentive—for developing new designs, codes and standards, and certification programs. Because much of the world closely monitors our technology development activities, our influence extends well beyond U.S. borders.

Outreach activities, conducted through publications, workshops, and special events, such as the Solar Decathlon, provide the communication path for us to pass the fruits of our R&D to large numbers of potential users, as well as information to policy makers. Technical progress is not the only commodity reported. For example, the latest developments regarding ES&H issues, such as decommissioning and recycling of components, are also communicated.

Feedback received through user contacts can be used constructively to determine R&D priorities and shape technology development.

Lastly, our international activities allow us to remain abreast of foreign technology developments and offer the possibility for collaborative R&D.

3. TA Supports the Systems-Driven Approach

The goal of TA activities, such as those conducted under the auspices of the Solar Energy Technologies Program, are often thought to be exclusively directed toward accelerated adoption by the user. A frequently underused benefit is user feedback, which can help maintain relevance and direction of R&D activities, be used to direct and prioritize R&D, suggest policy or legislative changes, and help set incentives.

TA activities support all three of the components of systems-driven analysis (i.e., benchmarking, modeling, and analysis) [4]. They provide benchmarking data to identify deployment issues and set research goals. They contribute hard cost and performance inputs to validate models. And lastly, they provide input to assist the analysis of potential market impact.

4. Conclusions

TA activities form an essential part of any technology program, providing mechanisms for communication with potential users, as well as with policy makers. In return, valuable feedback is obtained that can be used to shape future technology development activities.

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[1] R.F. Hirsh, *Technology and Transformation in the American Electric Utility Industry*, Cambridge University Press (1989).

[2] B. Ryan and N.C. Gross, "The Diffusion of Hybrid Seed Corn in Two Iowa Communities," *Rural Sociology* **8**, 15-24 (1943).

[3] E.M. Rogers, *Diffusion of Innovations*, Free Press, New York, 4th ed. (1995).

[4] C. Cameron, "The Systems-Driven Approach, What It is and Why Do It," DOE Solar Program Review Meeting 2004, October 25-28, 2004, Denver, CO.

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